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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,438	06/26/2001	James L. Foran	15-4-1152.00	9657

26111 7590 01/02/2004

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EXAMINER	
YANG, RYAN R	
ART UNIT	**PAPER NUMBER**
2672	4

DATE MAILED: 01/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/888,438	FORAN, JAMES L.	
	Examiner	Art Unit	
	Ryan R Yang	2672	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 September 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. This action is responsive to communications: Amendment, filed on 9/24/2003. This action is final.

2. Claims 1-11 are pending in this application. Claims 1 and 9 are independent claims. In the Amendment, filed on 9/24/2003, claims 1 and 9 were amended.

3. This application claims benefit of 60/219,006 dated 7/18/2000.

4. The present title of the invention is "Method and system for presenting three-dimensional computer graphics images using multiple graphics" as filed originally.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knittel et al. (6,532,017) and further in view of Duluk, Jr. et al. (6,597,363).

As per claim 1, Knittel et al., hereinafter Knittel, discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units, comprising the steps of:

(1) allocating, to each GPU, three-dimensional computer graphics data such that said allocated three-dimensional computer graphics data correspond to a portion of the

scene that lies within the rectangular subvolume to which that GPU has been assigned (Figure 7 V-Bus to 210 "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipeline has the functions of a GPU);

(2) rendering, by each of the GPUs, said allocated three-dimensional computer graphics data (where each pipeline can perform "interpolation, classification, gradient estimation, illumination, and compositing", Abstract);

(3) combining said rendered three-dimensional computer graphics data, thereby producing a three-dimensional computer graphics image (Figure 4 29 "the colors, levels of brightness, and transparencies assigned to all of the samples along all of the rays are applied as illustrated at 29 to a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32 for display on image plane 16", column 9, line 34-40); and

(4) presenting, for viewing, said combined three-dimensional computer graphics image (Figure 4 32).

Knittel discloses a method for presenting three-dimensional computer graphics images using multiple graphics processing units. It is noted that Knittel does not explicitly disclose "wherein said allocated computer graphics data that correspond to the portion of the scene includes at least one of first data for a first graphics primitive having first vertices that lie within the rectangular volume to which that GPU has been assigned and second data for a second graphics primitive having a vertex that lies outside of the

rectangular subvolume to which that GPU has been assigned", however, this is known in the art as taught by Duluk, Jr. et al., hereafter Duluk. Duluk discloses a graphics processing method in which vertices outside of a volume as well as vertices inside a volume are included within a rectangular volume for processing (Figure 31A where a tile is considered a volume).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Duluk into Knittel because Knittel discloses a method of multi-processing a 3-D image and Duluk discloses the primitive vertex information outside of a subvolume can be included in subvolume processing in order to properly calculate a subvolume image.

7. As per claim 2, Knittel and Duluk demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses said allocating further comprises loading, into a memory cell accessible by that GPU, the three-dimensional computer graphics data corresponding to a portion of the scene that lies within the rectangular subvolume to which that GPU has been assigned (Figure 6 204 "section memory 204 is used to store sections of a volume during rendering of the volume data set by the VRC", column 14, line 47-48 and Fig. 10 depicts loading of the subvolume to memory).

8. As per claim 3, Knittel and Duluk demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses, before step (2), the steps of:

(5) determining a viewing position (Figure 1 depicts selecting a viewing direction); and

(6) communicating said determined viewing position to each GPU ("A first interpolation unit 244 interpolates the z-gradient in the z direction, resulting in four intermediate values", column 12, line 64-66, therefore, the viewing direction is known by the GPU).

9. As per claim 4, Knittel demonstrated all the elements as applied to the rejection of dependent claim 3, supra, and further discloses said combining further comprises the step of:

(7) ordering said rendered three-dimensional computer graphics data based on locations between said determined viewing position and each rectangular subvolume (Figure 10 shows the subvolume is ordered into DRAM).

10. As per claim 5, Knittel and Duluk demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses said combining further comprises the step of:

(8) blending said rendered three-dimensional computer graphics data (Figure 4 29 "a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32", column 9, line 36-39).

11. As per claim 6, Knittel and Duluk demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Knittel further discloses said combining is performed by at least one image combiner (Figure 5A 124 where Figure 5A is a block diagram of a pipeline).

12. As per claim 7, Knittel and Duluk demonstrated all the elements as applied to the rejection of dependent claim 6, supra, and Knittel further discloses each of the at least one image combiner has an associated frame buffer for storing said combined three-dimensional computer graphics image (Figure 14 200 where the pixel memory stores said combined three-dimensional computer graphics image).

13. As per claim 8, Knittel and Duluk demonstrated all the elements as applied to the rejection of dependent claim 6, supra, and Knittel further discloses an output of the at least one image combiner is an input for another image combiner (Figure 14 where the output of 124 Compositing is output to Slice FIFO, to 250 Ray Shift Register, through MUX, then to next Compositing Unit).

14. As per claim 9, Knittel discloses a system for presenting three-dimensional computer graphics images using multiple graphics processing units, comprising:

memory for storing three-dimensional computer graphics data (Figure 14 100);

at least one GPU for rendering a portion of the three-dimensional computer graphics data that corresponds to a rectangular subvolume to which said at least one GPU is assigned to a rectangular subvolume (Figure 7 V-Bus to 210 "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipeline has the functions of a GPU and each rendering pipeline renders a volume of voxel);

a communications means for communicating a viewing position to each of said at least one GPU ("A first interpolation unit 244 interpolates the z-gradient in the z

direction, resulting in four intermediate values", column 12, line 64-66, therefore, the viewing direction is known by the GPU); and

at least one image combiner for combining the three-dimensional computer graphics data rendered by said at least one GPU, to produce a three-dimensional computer graphics image (Figure 14 has a plurality of Compositing Unit);

Knittel discloses a system for presenting three-dimensional computer graphics images using multiple graphics processing units. It is noted that Knittel does not explicitly disclose "wherein said portion of the three-dimensional computer graphics data includes at least one of first data for a first graphics primitive having first vertices that lie within the rectangular volume to which said at least one GPU is assigned and second data for a second graphics primitive having a vertex that lies outside of the rectangular subvolume to which said at least one GPU is assigned", however, this is known in the art as taught by Duluk, Jr. et al., hereafter Duluk. Duluk discloses a graphics processing system in which vertices outside of a volume as well as vertices inside a volume are included within a rectangular volume for processing (Figure 31A where a tile is considered a volume).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Duluk into Knittel because Knittel discloses a system of multi-processing a 3-D image and Duluk discloses the primitive vertex information outside of a subvolume can be included in subvolume processing in order to properly calculate a subvolume image.

15. As per claim 10, Knittel and Duluk demonstrated all the elements as applied to the rejection of independent claim 9, supra, and Knittel further discloses said memory is memory cells such that each said memory cell is accessible by only one of said at least one GPU ("The voxels are supplied to the pipelines 210-0- 212-3, respectively, in 4-voxel groups in a scanned order", column 15, line 9-11).

16. As per claim 11, Knittel and Duluk demonstrated all the elements as applied to the rejection of independent claim 9, supra, and Knittel further discloses wherein at least one of said at least one image combiner is configured to receive the output of at least one other of said at least one image combiner (Figure 14 where the output of 124 Compositing is output to Slice FIFO, to 250 Ray Shift Register, through MUX, then to next Compositing Unit).

Response to Arguments

17. Applicant's arguments with respect to claims 1-11 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Inquiries

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Ryan Yang** whose telephone number is **(703) 308-6133**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Michael Razavi**, can be reached at **(703) 305-4713**.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 305-47000377.

Ryan Yang
December 17, 2003

RICHARD HJERPE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600